The Dutch solution to soil-pollution
Legislation to solve a serious environmental problem

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1. Soil: The foundation of our existence

Soil is literally the basis of our existence: we build our homes on it, spend our free time on it, we get our water from it, cultivate crops on it, and extract raw materials such as clay and gravel from it. Soil is more than just a pile of sand and organic matter; it's an impressive system in which many natural processes take place and many forms of life occur. It is home not only to rabbits, mice, and moles, but also to all sorts of tiny creatures, fungi and bacteria. They ensure hat leaves decompose, which allows other plants to grow, and these plants serve as food for animals and people. Soil is therefore an indispensable link in the circle of life. It is also a natural filter for our drinking water: rain seeping through soil is filtered and purified, and by the time it reaches the groundwater it is clean. About two-third of our drinking water originates in groundwater, which is also regarded as part of the soil.

- Facts -
An estimated twenty percent of the surface soil in the Netherlands is seriously contaminated. Almost 100,000 former and existing industrial sites are contaminated. The sites include rubbish dumps, scrapyards, paintfactories, galvanishing plants, printworks, petrolstations, garages, chemical plants, textile mills and the notorious gasworks where coal gas used to be produced. The government estimates the total costs of cleaning up this dirty legacy at between 25 and 60 billion euro.

Functions

The basic aim of the current policy is to achieve and preserve a sustainable soil quality (National Environmental Policy Plan 2). This means that the soil must retain all it's functions for years to come. The Soil Protection Act lays down a statutory "duty of care", which means that soil contamination occurring during certain activities must be cleaned up by the person who causes it.

2. Soil Contamination

The Netherlands first realized the seriousness of the problem in 1980, with the revelation tat a residential area in the small town of Lekkerkerk had been built on land contaminated with chemical waste. Television images of residents evacuated to caravans and houses demolished to their foundations shocked the public. A survey conducted shortly afterwards identified 350 seriously contaminated sites. Today, more than two decades later, we see soil contamination for the gigantic environmental problem it really is. The number of contaminated sites is now estimated not a 350, but at more than 100,000.

How did this get this bad?

The main cause of soil contamination is the careless handling of raw materials and waste products. In the past, it was common practice to dispose of waste products by simply dumping them. Moreover, waste management was often rudimentary, which led to accidents in the storage of raw materials and leakages from tanks and pipelines. Dangerous substances would seep into the soil for years. Waste products were also used to asphalt roads and fill in ditches, with scant thought for the consequences. And all kinds of chemical waste ended up on domestic rubbish dumps. In many places, the soil was contaminated because it had been leveled up with polluted dredging sludge or mining waste.

The problems did not become evident until years later with the construction of new residential areas.

Contamination occurred over large areas following the deposition of harmful substances present in the air and surface water. This "diffuse contamination" affects the entire country, and is caused by air pollution from factories, motor traffic and fertilizers, and by polluted river water. Wide ranges of substances have contaminated the soil. Heavy metals occur in almost 70% of soil contamination cases. Other frequently occurring substances are solvent, tar, pesticides, and petrol.

Risks

Soil contamination is usually invisible and does not smell. This is why the seriousness of the problem came to light so late in the day. People, plants, animals and the economy all suffer from the effects of soil contamination:

- people ingest substances from contaminated soil by eating vegetables grown in contaminated soil, inhaling harmful fumes, and children play on contaminated soil;

- plants on polluted soil either grow poorly or die. Animals also suffer from contamination. Sheep grazing on the forelands of rivers can die from an overdose of copper;
- as an example of economic damage, several Dutch reservoirs had to close because the ground water was seriously polluted by soil contamination. Similarly, some soil can no longer be used for agriculture because of contamination.

3. How the soil cleanup regulations work

New Law

In the late 1970s, when the magnitude of soil contamination became apparent, the government realized that there were hardly any rules to deal with even the worst cases. In 1983, therefore, it passed the Soil Cleanup (Interim Measures) Act. Though not the original intention, this piece of legislation served for more than 10 years as a legal safety net to deal with existing cases of soil contamination. The 1983 Act was repealed on May 15 1994, and its provisions, together with some amendments and additions, were assimilated into the Soil Protection Act. These cleanup regulations are intended to deal with "old" cases of soil contamination, i.e. cases that came to light before January 1 1987, when the Soil Protection Act entered into force. For cases that have arisen since that date, the Soil Protection Act contains regulations on an "duty of care" for the soil. This imposes a legal obligation to clean up contamination resulting from certain activities listed in the Act.
The Soil Protection Act is partly a framework-act. This means that it presents a normative framework for dealing with different types of case within which the government can make rules.

Who has to clean up?

In the new cleanup regulations, the government introduces a clear division between "self-managed cleanup" and "government cleanup" operations. In accordance with the "polluter pays"-principle, the party responsible for the pollution is obliged to pay for its cleanup. This may be a company, an individual homeowner, or even a municipality. Self-managed cleanups mean that the polluter is responsible for conducting soil analysis, drawing up a cleanup plan, and taking cleanup measures. In cases where this is impossible, for instance if the polluter cannot be found, the government may hold the owner/leaseholder of the property responsible for the

quality of the soil. The polluter or owner/leaseholder is therefor obliged to pay the costs of self-managed cleanup. Commercial users (non-polluters, owners, or leaseholders) may be obliged to conduct a soil analysis study and take provisional safety measures.
The Dutch provinces (12) are responsible for approving cleanup plans drawn up by polluters or owners/leaseholders. If a polluter or owner/leaseholder refuses to clean up a contaminated site, the government may force them to do so. Only if this proves impossible will the government act as a "safety net" and conduct the cleanup itself.
In this way, the cleanup regulations in the Soil Protection Act increase the government's power to deal with polluters. Below, we look at the role of the government in soil cleanup, the standards that apply, and the rules applying to self-managed cleanup and government cleanup operations.

Overall role of government

The main authorities involved in planning and implementing soil cleanup are the provinces and the four large municipalities of Amsterdam, Rotterdam, The Hague and Utrecht. For soil cleanup purposes, these four municipalities have the status of provinces, and therefore covered by the term "province" in this abstract. All municipalities have the key task of providing public guidance on soil contamination. They are also obliged to inform the provincial authorities of all cases of soil contamination within their borders and make a significant financial contribution tot the cleanup of contaminated sites. Finally the are charged with enforcing the regulations.

As for the provinces, they have both an advisory and supervisory role with regard to self-managed clean-up operations. Before any such operation may begin, the provincial authorities have to approve the cleanup plan draw up by the party performing the cleanup. When drawing up their cleanup plan, incidentally, those undertaking cleanup operations should seek professional advice (e.g. from an engineering consultancy). In addition, the provinces are responsible for performing "government cleanup" operations, to which they also make a financial contribution.
Central government provides most of the funding for government cleanup, and has the task of drawing up standards and general guidelines.

Standards

The government has formulated standards for measuring levels of soil contamination. Where concentration of dangerous substances are found to be below

the "targetlevel", the soil is rated clean and "multifunctional" – i.e. suitable for all uses.

Where concentrations are between the targetlevel and the "action"level, the soil is considered
"lightly to moderately contaminated" – i.e. within the "grey area" where the risks are considered "acceptable". Where harmful substances are identified in concentrations higher than the actionlevel, the soil is said to be "seriously contaminated".

The intervention value is the level above which concentrations of dangerous substances are considered to pose an unacceptable risk to human beings, animals and plants: the site is seriously contaminated. The risk of contamination to human beings is measured by the extent an nature of their contact with the substances in question. In establishing intervention values, researchers calculate a "potential risk", which assumes that all possible exposure routes are present.

Where a site is seriously contaminated, it should be cleaned up as soon as possible. But it is impossible to clean up all contaminated sites at once. So the provinces determine the urgency of each case on the "actual risk". The greater the risk to human beings or the environment, the more urgent the need to clean up the site.
When the provincial authorities designate a site in urgent need of clean up, there are two possible courses of action:

- very urgent cleanup operations must begin within four years;
- a date must be fixed for less urgent cleanup operations at least four years after designation.

If a seriously contaminated site is designated as non-urgent, cleanup will be necessary, but a date need not to be fixed. This is the case where lead concentrations are above the intervention values but there is no actual risk to human beings or the environment. Since the contamination occurs some meters below the soil's surface, no exposure takes place.

Self-managed clean up

Anyone intending to clean up a contaminated site or take action to reduce or move contaminated soil must report their intention to do so in advance to the provincial authorities. This information is then passed on to the Regional Environmental Inspectorate and the municipality concerned. The general public are informed by

means of advertisements in daily newspapers and free door-to-door newspapers. If the contamination is serious, the party concerned must submit a cleanup plan, together with soil analyses study reports, to enable the provincial authorities to assess the intended procedure. The plan will need provincial approval to go ahead. Under the General Administrative Law Act, it is possible to appeal against approval decisions.

If there is any risk that a self-managed cleanup operation will not proceed according to plan, the provincial authorities may order the polluter, owner, or leaseholder of a site to conduct a soil analysis study or cleanup order either of its own volition or at the request of a third party.
The government may force other commercial users, such as tenants, to perform soil analysis studies and take safety measures.
The Soil Protection Act states that no cleanup order may be imposed if the owner or leaseholder of the site in question can prove that he is not the polluter and that he has no connection with the polluter, no indirect involvement in the contamination, and was not informed or could not reasonably have been expected to know of the contamination in question

Special cleanup agreements are made with some polluters. These include industry-wide agreements on the cleanup of contaminated industrial sites, called BSB (Decontamination of Existing Industrial Sites) agreements. A special arrangement has been drawn up for the cleanup of underground storage tanks, including oil tanks.

Government Cleanup

Where the polluter or user cannot be found or cannot afford to perform a self-managed cleanup operation, the government serves as a safety net. In such cases, the provincial authorities are responsible for both soil analysis and clean up. The central government, province and municipalities all contribute to the costs of these cleanup operations. If possible the government tries to recover the cost from the pollutes.

Since soil decontamination is a big job, the provinces draw up an annual soil cleanup program, as a part of their environmental program. This program lists all known cases of soil contamination, and presents an outline of the soil cleanup

operations intended for the following four-years period. It is bases on information concerning suspect locations received from members of the public and environmental organizations, on reports from municipalities and on data from the provincial authorities. It is drawn up in consultation with the municipalities concerned and the Regional Environmental Inspectorate, and the public have a right to participate in the decisions-making process.

Central government pays most of the costs of government cleanup operations in the form of annual block grants tot the provinces. In cases of serious contamination costing less than 5 million euro to clean up, the province distributes its grant among the projects. In cases of large-scale soil contamination costing more than 5 million euro to clean up, central government makes funding available on a project phase basis with reference to soil analysis studies an d cleanup plans submitted by the provincial authorities.

In addition to these "safety net" cases, which the government is forced to undertake, some authorities – such as municipalities or the Ministry of Defense – may perform their own "self-managed clean up operations" This will often occur in cases of urban renewal. These operations do not receive funds under the Soil Protection Act, but out of another budget.

Other Legislation

Other Acts also contain provisions concerning soil contamination

The Environmental Management Act

Companies need licenses to operate. Anyone applying for a license under this Act may be obliged to perform a soil analysis study called a "baseline study". This study is intended to determine the state of the soil at the time the license was granted, so that it can be later established whether the license holder has contaminated the soil. If this is found to be the case, the government may demand cleanup measures. If a repeat study produces the same results as the baseline study, this will prove that the license holder has not caused any contamination.

Housing Act

The housing act requires municipalities o prevent construction on contaminated soil. This is usually done by means of building bye-laws requiring applicants for planning permission to submit a soil analysis repot with their application.

Building Materials Decree

The Building Materials (Soil and Surface Waters Protection) Decree came into effect on 1 July 1999 for the use of stony materials and earth in construction and other works. The purpose of the Decree is to prevent the pollution of surface waters, groundwater and soil. Harmful substances leaching form stony building and other materials or contaminated earth can cause pollution. The Decree is in line with the general thinking on quality and quality control. It includes rules, regulations and standards which guarantee a specified quality of building materials, including earth. The Building Materials Decree affects all parties who play a role in the building process, such as manufacturers and suppliers of building materials, local authorities, which are responsible for enforcement of the Decree, laboratories which test the environmental quality of building materials, certifying bodies, etc. However individuals renewing a roof tile for example may also be affected by the decree.

4. Cleanup

Government cleanup operations performed under the Soil Protection Act involve a historical study, indicative site study, a further study followed by a cleanup study. The cleanup study compare a number of cleanup methods, one of which is chosen. This seems easy, but in fact is quite difficult. Striking a balance between different interest is a laborious process. What is financially and technically feasible? Certain circumstances will make it impossible to restore multifunctionality. These are referred to as "locationspecific circumstances", in which it is possible to deviate from the aim of restoring multifunctionality.

Clean up

Once a cleanup method has been chosen, a cleanup plan must be drawn up. This sets out the entire intended cleanup procedure: where to dig up soil, whether to build a sheetpile wall and isolate the pollution, and whether to

Populair cleanup methods

On Site (*In-situ*)	**Off site (*Ex-situ*)**
Pump and treat	Rinsing and extraction
Chemical Oxidation	Thermal treatment
Natural Attenuation	Immobilization

siphon off groundwater. The cleanup plan also covers safety measures, temporary evacuation and demolition of buildings. There are different ways of cleaning up soil and groundwater. The most common are discussed below.

Removal

The most thorough cleanup method consists of the removal of contamination from the soil and groundwater. This is usually very intrusive. Soil removal in an residential area will mean tearing up roads and digging up parks and gardens. Sometimes, residents even have to leave their homes. Removal need not however necessitate major digging operations. Soil can also be cleaned in situ. The party performing the cleanup operation may, flush water through the soil with water or introduce bacteria that will break down oil.

Soil Cleaning

Removing soil does not solve the problem entirely. Where is the contaminated soil to go? Ever since soil contamination became a recognized problem, many cleanup plants have been built. Nevertheless, much soil has ended up on dumps without being cleaned, because dumping is cheaper.
To deal with the problem, the government has established the Center for Soil, which people intending to perform cleanup operations must consult before digging up contaminated soil. This obligation does not apply if the contamination is not serious. The SCG determines whether contaminated soil can be cleaned. Only if the SCG declares that cleaning is technical or economical not feasible, soil can be landfilled.

Isolation

It is not always possible to remove contamination. It may be too expensive, entail too many risks, or be impossible for other reasons such as the presence of a protected historic building on the contaminated site. In such "location specific circumstances", the party performing the cleanup operation may opt for isolation, whereby contaminated substances are not removed but sealed off. Isolation needs constant maintenance. Regular checks have to be made to ensure that contamination does not spread; and foil, sheetpile walls, and drainage pipes must all be replaced in time. Those intending to perform a cleanup operation must set out their intended maintenance measures in a maintenanceplan.

5. Actual en future focuses

Asbestos

Asbestos is a widespread used building material. However the product erodes and small hazardous fibers contaminate soil. Handling soil which contains asbestos an be very harmful. Inhaling fibers can be deadly to human beings. Many contaminated sites are being cleaned up right now. Usually the contaminated soil can be cleaned in rinsing-and-extraction plants.

Reuse of slightly contaminated sludge and soil

In some building such as dikes, road foundations and noise barriers it is better to reuse slightly contaminated sludge or soil than scarce – so called- primary sand from sea or rivers. In these works contamination will not be exposed to human beings or animals. However it is important that the soil which is used is not subject to leaching from contaminants to the groundwater. Rules for reusing slightly contaminated sludge or soil are taken down in the The Building Materials Decree.

Countrywide covering picture of soil pollution

Almost every municipality and province archives soil quality data in databanks. By visualizing this data in Geographic Information Systems (GIS) you can obtain a local overview of soil pollution. With statistic extrapolation it is possible to predict the soilquality of areas that aren't even investigated. This is of course not possible with contamination caused by local sources.
The intention is to join all local GIS'ses to an countrywide covering picture of soil pollution by the year of 2005.

Combined funding of clean up operations

Many contaminated sites are situated in industrial area's. Feature of these industrial area is the popularity by industrial businesses. By contracting local businesses, local governments can make a deal. This deal means that businesses pay a part of the cleanup operation and afterwards can buy the cleaned up site.

6. Concerned Organizations

The ministry of VROM (Housing, Spatial Planning and the Environment)

VROM's goal is to make a policy in pace and harmony with current social, technological and political developments. VROM implements that policy in close co-operation with other ministries, local and regional governments, social organizations, businesses and interest groups as well as other national governments.

The Ministry has to rely on other organizations in carrying its policy. Ideally those partners adapt to laws and rules voluntarily. However that is not always the case. The Ministry Inspectorate 's responsibility is to make companies adopt environmental regulations and make municipalities observe zoning schemes.

More information: http://www.vrom.nl/international

RIVM

The National Institute of Public Health and the Environment (RIVM) conducts research into public health and environmental issues in the Netherlands. It also operates as the Office for Environmental Assessment. RIVM conducts research commissioned by the ministries of Health, Welfare and Sport (VWS), Housing, Spatial Planning and the Environment (VROM) and Agriculture, Nature Management and Fisheries (LNV). Policymakers use RIVM research findings to develop, implement and enforce policy. RIVM not only conducts research itself, but gathers data from all over the world, which it then interprets and applies.

More information: http://www.rivm.nl/en

Local governments: Provinces (12) and Municipalities (489)

Develop local policy and supervise cleanup operations

Center for Soil

To keep this process of soilremediation on the right track, the government founded SCG: Center for Soil Treatment (1989).

The task of SCG was to stimulate the development of soil treatment technologies. In addition, its objective was to prevent the dumping of treatable soil and to stimulate the reuse of treated soil in an environmentally sound manner. In 1998, the SCG was thoroughly reorganized. The background to this reorganization was twofold. In

the first place, the soil decontamination marked had come of age. In the second place the execution of soil management was decentralized to the provinces and local councils. A time for SCG to re-determine its mission: "The SCG wishes to make its knowledge and expertise of the controlled processing of soil streams available to the state, the provinces, the local councils and the district water boards and, as an independent center of knowledge, participate in improving and assuringquality in the soil sector. In addition, the SCG will in a transparent manner carry out the tasks, that has been entrusted to it and embedding law, concerning the evaluation of whether soil can be decontaminated, and the issuing of certificates stating that soil cannot be decontaminated. The name changed with the changed mission: Service Centrum Grond (Center for Soil). The abbreviation SCG could be retained.

More information: http://www.scg.nl/SCG/scg_e.htm

Appendix:

- Soil Protection Act;
- The Circular on target values and intervention values for soil remediation;
- Annexes to the circular above

Parts of this abstract are derived from a information booklet of the Ministry of Housing, Spatial Planning and the Environment and information from the website www.vrom.nl/international.

국문요약

토양

토양은 인간의 존재의 기초가 되며, 모든 생물의 생활 터전이다. 토양은 물이 여과되고 정화되기도 하며 식수를 제공해주는 등, 생명 순환에서 필수 불가결한 연결고리가 된다. 토양오염에 관한 네덜란드의 기본 정책은 토양의 현재 상태를 확인하고 안전하게 보존하는 것이다. Soil Protection Act 에는 토양의 보존 의무와 함께, 토양오염을 유발한 자가 토양의 정화할 것을 명시하고 있다.

토양오염

1980 년대에 Lekkerkerk 라는 작은 마을에서 처음으로 토양오염이 발견된 이후 그 심각성이 널리 인식되었다. 현장 조사를 통해 약 350 여개의 장소가 오염되었음을 확인하였으며, 20 년이 지난 지금은 약 100,000 개 이상의 토양오염 현장이 존재하고 있다.

토양 오염은 주로 오염물질의 부주의한 조작이나 오염물질의 무단 투기에 의해 발생한다. 아직도 폐기물의 관리가 매우 초보적으로 이루어지고 있으며, 오랫동안 오염된 토양이 그대로 방치된 경우가 많다. 토양오염은 공기와 지하수를 통해 계속 확산되고 있다.

토양오염은 일반적으로 눈으로 확인이 되지 않기 때문에, 그 심각성이 상대적으로 낮게 알려져 있다. 그러나 토양오염은 사람을 포함한 생명체에 미치는 영향은 매우 크며, 몇몇 저수지는 오염된 토양으로 인해 오염된 지하수로 인해 폐쇄되기도 했다.

토양오염복원에 관한 법률

New Law. 1970 년 말까지도 토양오염을 다룰 적당한 법률이 없었으나, 1983 년에 비로소 토양정화법(Soil Cleanup Act)이 제정되었다. 이 법은 1994 년에 soil protection act 로 개정되었으며, 1987 년 이후에는 정화 의무 부과를 다루는 귌 uty of care of soil' 항목이 추가되었다. 이 법은 주로 토양오염을 다루는 법률의 골격을 이루고 있다.

Who has to clean up? 오염된 토양은 크게 귌 elf-managed cleanup' 현장과 'government cleanup' 현장으로 나뉜다. 오염된 토양의 복원은 오염원인자가 책임지는 것을 원칙으로 하며, 오염 유발자가 분명치 않은 경우에는 소유주가 정화를 실시하게 된다. 이러한 조치는 정부에 의해 강력하게 추진되고 있다.

Overall role of government 오염토양의 정화 계획과 수행은 주로 province 와 4 개의 municipality - 암스테르담, 로테르담, 헤이그, 우트레트 - 가 담당하게 된다. 4 개 도시는 주당국에 오염 상황을 공지해야 하며, province 는 귌 elf-managed cleanup' 현장을 감독하고

'government cleanup' 현장에 대한 책임을 지게 된다. 중앙 정부는 재원을 지원하며, 기술과 일반적인 기준들을 제공해준다.

Standards 정부는 토양오염 정도를 평가하는 기준을 설정해왔다. 일반적으로 토양오염이 target level 과 action level 사이에 존재하면 그 위험이 어느정도 감당할 만하다고 평가하지만, action level 을 넘으면 심각하게 오염된 것으로 간주하게 된다. Action level 이상의 오염에는 인간과 동식물에 심각한 위험을 초래할 수 있기 때문에 빠른 시간 내에 정화가 요구된다. 일단 오염이 확인되면 빠른 시간 내에 정화를 수행해야하지만, 정화에는 많은 시간이 소요되기 때문에 우선순위를 정해수 실시하게 된다. 매우 급한 경우는 4 년 이내의 한 시점까지 수행이 완료되어야 한다.

Self-managed clean up 정화 시행자는 province 에 그 사실을 알려야하며, 이 정보는 동시에 지역 환경 감시국과 관련 도시에 전해진다. 일반 사람들도 신문을 통해 이 정보를 알 수 있다. 토양 보전법에 의하면 소유자나 임차인이 토양 오염과 관련이 없음을 증명할 수 있으면 정화 의무를 부과할 수 없다. 한편 BSB 라고 불리는 협약은 지하저장탱크, 기름 저장 시설의 정화 등 산업체 시설의 정화에 대한 내용을 다루고 있다.

Government clean up 토양오염 원인자를 찾을 수 없거나, 오염자가 스스로 정화할 수 없을 때, 정부는 safety net 의 역할을 한다. 즉, province 당국이 토양오염 분석과 정화를 담당하게 된다. 일반적으로 정화 작업은 대규모로 이루어지기 때문에 장기간의 시간을 요하게 된다. 정화 작업의 계획과 수행에 관한 의사결정시에는 지역주민들도 참여할 수 있다. 중앙정부가 대부분의 비용을 부담하며, 오염정도가 심한 현장은 5 million euro 이하의 비용을 province 당국이 정화 작업을 위해 배분한다. 이외에도 도시재정비와 같은 사업의 경우 도시나 방위국이 직접 정화를 수행하기도 한다.

관련법률

The Environmental management act 각 기업은 수행 자격증을 필요로 하며, 이 법에 의해 자격을 부여받은 기업은 baseline study 라는 불리는 토양 분석 연구를 수행하도록 부과된다.

Housing act 이 법을 통해 도시 당국이 오염된 토양에 건물 등을 건축하는 것을 방지할 수 있다.

Building material decree 건설 중에 발생하는 암석이나 토양의 활용을 촉진하기 위해 1999 년에 제정된 법률로서, 이 법안은 지표수, 지하수, 토양의 오염을 방지하는 것을 그 목적으로 한다. 이 법은 건물의 시공과 관련된 모든 당사자에게 효력을 미친다.

정화

정부가 수행하는 정화 작업에는 historic 연구, indicative 현장 연구, 정화 후 further study 등을 포함한다. 이러한 일련의 작업은 일견 쉬워 보이지만 여러 가지 과정 사이에서 균형을 잡아야하기 때문에 매우 복잡하게 이루어진다.

Clean up 일단 정화방법이 결정되면 정화 계획이 수립된다. 정화 계획에는 전체 공정과 함께 안전 조치, 임시 작업 계획 등 작업에 관련된 모든 것이 포함된다.

Removal 가장 확실한 방법은 토양과 지하수를 동시에 완전하게 제거하는 것이지만, 주거지역과 같이 토양 제거가 불가능한 경우가 발생한다. 이러한 지역은 토양 수세법이난 생분해법과 같은 방법을 이용할 수 있다.

Soil cleaning 오염토의 제거는 오염된 토양을 저장하거나가 보관하기 위한 또다른 시설을 필요로 한다. 따라서 정부는 'center for soil'을 마련하였다. 한편 정화법의 수행 이전에는 SCG 로부터 정화가 가능한지 자문을 얻어야 한다.

Isolation 각 현장의 특별한 사정에 의해 오염원을 제거하는 것이 용이하지 않을 때, 오염지역을 차폐할 수 있다. 이 때 차폐시설의 설치 후 오염이 확산되지 않는지 정규적인 감시가 필요하다.

미래의 당면한 문제

Asbestos (석면) 석면은 일반 건물에 널리 사용되는 물질로 매우 독성이 강하다. 토양이 만약 석면에 의해 소량이라도 오염이 되면, 그 토양과 접촉한 생물체는 심각한 위해를 입게 된다. 이 물질은 rinsing and extraction 방법에 의해 정화된다.

Reuse of slightly contaminated sludge and soil 만약에 오염된 토양이 인간이나 동물이 노출되지 않으며, 오염정도가 심하지 않으면 그 오염토양은 재사용하는 것이 더 낳을 수 있다. 그러나 이 때 오염물이 토양으로부터 지하수로 용출되어서는 안된다. 재사용에 관한 내용은 귊 uilding material decree'에 제시되어 있다.

Countrywide covering picture of soil pollution GIIS 를 통해 각 도시나 province 로부터 토양오염에 대한 정보가 수립되면 전국적인 토양오염 그림이 작성된다. 이로부터 토양 오염에 대한 정보를 얻을 수 있으며, 대체적인 오염정도를 확인할 수 있다.

Combined funding of clean up operation 일반적으로 산업부지에서 토양오염이 많이 발견되며, 따라서 정부와 업체는 특별한 협정을 맺어 업체가 정화비용의 일부를 부담한 후, 부지를 구입하기도 한다.

관련기구

The ministry of VROM (Housing, Spatial Planning and the Environment) VROM 의 목표는 현재의 사회적, 경제적, 정치적 상황과 잘 조화하도록 정책을 수립하는 것이다. VROM 은 정책이 다른 부서, 지역, 관련 단체들과 잘 협력하여 수행되도록 돕는다. 보다 더 자세한 정보는 http://www.vrom.nl/international 에 나와있다.

RIVM 공중보건부와 환경부는 네덜란드의 공중보건와 환경에 관한 연구를 수행한다. RIVM 은 보건부, 복지부, 주택부, 환경부, 농업부 등에서 위임받은 연구를 수행한다. 더 자세한 정보는 http://www.rivm.nl/en 에 나와있다.

Local governments : Provinces (12) and Municipalities (489) 지역 정책을 개발하고, 정화작업을 감독

Center for Soil 정부는 토양 정화작업이 원활하게 이루어질 수 있도록, SCG 를 설치하였다: 즉, center for soil (1989). SCG 과업은 토양 정화 기술 개발을 촉진하는 것으로, 처리해야하는 오염토가 무단 방치되거나 매립되는 것을 방지하고 환경적으로 안전하게 재활용되는 것을 돕는다. 한편 이는 1998 년에 완전히 재조직되어, 추가적인 새로운 역할을 감당하고 있다.